

SCIENCE IN GERMANY

(From a German Correspondent.)

DURING the past year some interesting observations have been published with reference to the alterations in animals through external influences. One series of these researches is by Weissmann, on the transformation of the Mexican Axolotl into an Amblystoma (*Zeitschrift für Wissenschaftliche Zoologie*, xxv., 1875, Supplement). It refers, of course, to a phenomenon which is not now new; but it includes a number of original experiments and observations, and is especially important for the conclusions drawn from these. The Axolotl (*Siredon Mexicanus*) and its allies in Mexico retain there, during life, in the natural state, the form and organisation of the larvæ of our Tritons; but, in artificially breeding them in Europe, they sometimes undergo a metamorphosis into an Amblystoma, i.e. an animal of the form of our fully developed Tritons. These peculiar departures from the natural behaviour of the Mexican Siredon, Weissmann desired to produce artificially, and with this view he entrusted the breeding of five eight-day larvæ to a lady, Fraulein v. Chauvain. All five actually underwent the desired transformation, having been put for six to eight months in water that was quite shallow, so that they were compelled frequently to leave the water, and become used to lung-breathing. Now, since, besides the Mexican Siredon species, which are never transformed in the natural state, there occur in the United States of North America quite similar animals, which, however, represent merely the temporary larva stage of various species of Amblystoma, the Mexican Siredon species have hitherto been regarded as forms that have remained at a lower stage of development, and, in the rare cases of metamorphosis by the action of changed conditions of life, have been incited to progression towards a higher stage. Weissmann, however, is now of a different opinion. He believes that the sudden and very remarkable transformation of the Siredon, which affects a whole series of organs, cannot be fully explained by the direct influence of changed conditions of life; and that should one see in such a transformation the leap-like (*sprungweise*) development of a new species or even genus, the hypothesis of a kind of life-force would be necessary. This teleological hypothesis should be avoided, according to Weissmann, and the transformation of the Siredon conceived as a not real but only apparent new formation of species, viz., as a reversion to a form which previously existed among the ancestors of the Siredon. Since the Perennibranchiata, at all events, represent the older form of the tailed amphibians, as it is indicated for the Amblystomas of North America in their Siredon-like larvæ, all Siredons are to be regarded as the descendants of Amblystomas, which were permanently depressed to that older form, and in their occasional metamorphoses have realised a reversion to the second phylogenetic stage (Amblystoma). Such a conception Weissmann supports by the following reasoning:—The possibility of Siredon having come from Amblystoma is proved by the fact that we sometimes see Triton-larvæ, which attain the full size and sex-forms of an adult Triton without being transformed; now the Tritons and Amblystomas are very similar animals, and their larvæ are again extremely similar to the Siredon. But it is possible also to indicate the probable causes which forced the Amblystoma-like ancestors of the Siredon to reversion into the Perennibranchiate form. According to Humboldt's view, the high table-lands of Mexico were formerly covered with extensive lakes, and the evaporation of such large water-surfaces must then have produced a very moist atmosphere, which is necessary to the naked amphibia living on land. Consequently, Amblystoma forms could at that time live in Mexico quite well. With disappearance of the waters, however, came the present extreme dryness of the air on the Mexican highlands, which allows only

the Amphibia living in water to survive, and is therefore probably the reason why the Amblystoma larvæ have gradually quite ceased leaving the water and being transformed, and thus have constituted the present Siredon species. If, then, the occasional transformation of Siredon to Amblystoma may be explained as a reversion, the necessity ceases of supposing for so sudden a change a special life force, which in Weissmann's opinion is necessary, should his theory be rejected.

Similar experiments on the change of organisation through action of external influences have been made by Schmankewitsch on low Crustaceans of the order of Branchiopoda. He also was led to experiment by natural occurrences. In the neighbourhood of Odessa (in Southern Russia) there is a salt lake which, with a view to salt production, was divided by a dam into two halves, so that in the lower, shut off part, salt was deposited in solid form, while the less salt upper portion alone, at the commencement, contained the Branchiopod *Artemia salina* in large number. In the year 1871 that dam burst; the very salt water of the lower half of the lake was diluted to about 8° of Baume's areometer, and at the same time there were carried into it large masses of *Artemia salina*. After the dam was repaired the concentration of the same water rose in 1872 to 14°, 1873 to 18°, 1874 to 25°. At the same time the *Artemia salina* present underwent a remarkable change. In 1871 they still had their characteristic form of tail. In 1874 the two lobes of it, as also their bristles, had entirely disappeared. Simultaneously the gills were enlarged, in correspondence to the smaller proportion of oxygen in the very salt water. The body as a whole, however, decreased in size, so that the new form corresponded almost exactly to that of *Artemia Mühlhauseni*, formerly regarded as a distinct species. This fact was tested experimentally, and the same results were obtained by artificial breeding in salt water of increasing degrees of concentration. Further, by the reverse experiment, the *Artemia Mühlhauseni* was, even in a few weeks, altered in the direction of *Artemia salina*; and this last form was, by continued dilution of the salt water, transformed into a *Branchipus*; i.e. a genus which, of larger dimensions than *Artemia salina*, has a somewhat different tail, and one abdominal segment more, and which also is propagated sexually, whereas parthenogenesis is the rule with *Artemia*. In natural water-pools, with various proportions of salt, Schmankewitsch found (in accordance with his experiments) various transition stages between the forms named, so that the increase of the amount of salt reduces the *Branchipus* form in size, segmentation, and initial form of the post-abdomen; and, with corresponding change of the gills, essentially modifies also the propagation, so that the strongest salt solutions harbour only *Artemia Mühlhauseni*. From all these facts it appears that the direct influence of changed conditions of life may, in course of a few generations, transform one species, or even one genus, into another, and this in both directions; so that there can be as little question of the reality of a reversion as of that of imperceptible small changes, which, accumulating through long periods of time, suffice for the formation of a new form. Such facts, however, seem little fitted to give support to the opinion of Weissmann, viz., that reversion only is capable of working a rapid and remarkable change.

SIEMENS' ELECTRIC LIGHT APPARATUS

THE comparatively infrequent employment of electric light, considering the great success achieved in its production, would at first sight appear to be due to something in the application of the electricity itself. It has been repeatedly and satisfactorily proved that a continuous and powerful light can be produced by electricity, and the

question naturally arises, Why is it not more frequently employed for practical purposes?

Unquestionably the first experiments with electric light were not successful, but this is generally the case with new inventions. Unfortunately, however, a feeling seems

to have arisen directly against the application of electricity for lighting purposes, or at any rate against the employment of the existing apparatus in the hope that more perfect may soon be invented.

The numerous cases in which powerful electric lights

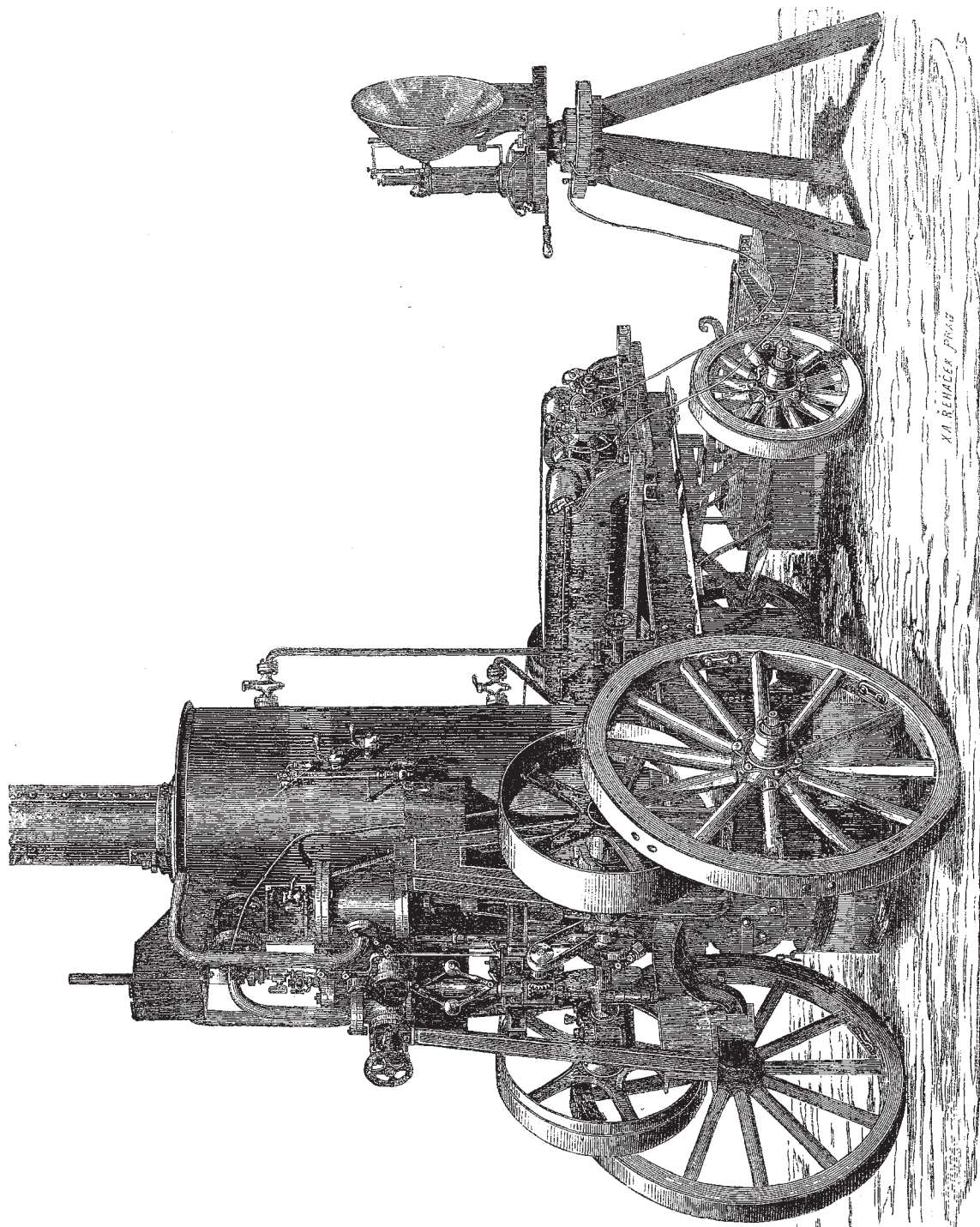


FIG. 1.—Dynamo-electric Light Apparatus with Portable Engine, Lamp, and Parabolic Reflector.

would be of service may be divided into two kinds : first those where a great number of lights are required at distant places, either simultaneously, or at intervals, and in varying numbers, such as lighting streets, extensive pre-

mises, &c. Second, those where only one or a few powerful lights are required, such as illuminating harbours and public places, as well as for lighthouses, signalling, and diving operations.

Great difficulty is experienced in properly adjusting the resistances and dividing the current, for the production of such a number of lights as is required in the cases of the first kind, and extensive experiments to overcome this difficulty have as yet been attended with only partial success.

It is to those of the second kind that we purpose to draw attention. Here the circumstances are quite altered, the cases of application are numerous, and the apparatus employed is perfect and proportionally cheap, and yet it is adopted not nearly so frequently as might be expected. A constant light equal to that of from 9,000 to 10,000 stearine candles can easily be produced, with a motive force of from eight to nine horse-power, and this at a cheaper rate than any other artificial light.

Such apparatus have lately been employed in various countries for various purposes, such as for engineering works, torpedo defences, signal lights, and in military field operations. It is to be hoped that its adoption in this country will soon be more general.

The following is a description of Messrs. Siemens Electric Light Apparatus, one of many that have been adopted in various countries. Comparative experiments have proved it to be the most powerful and at the same time the least expensive of all apparatus yet employed in the production of continuous electric light. It is a complete apparatus by itself, in which the core of the armature is fixed and the wire-helix alone caused to rotate. By fixation of the armature core great inductive power is obtained, and consequently powerful currents.

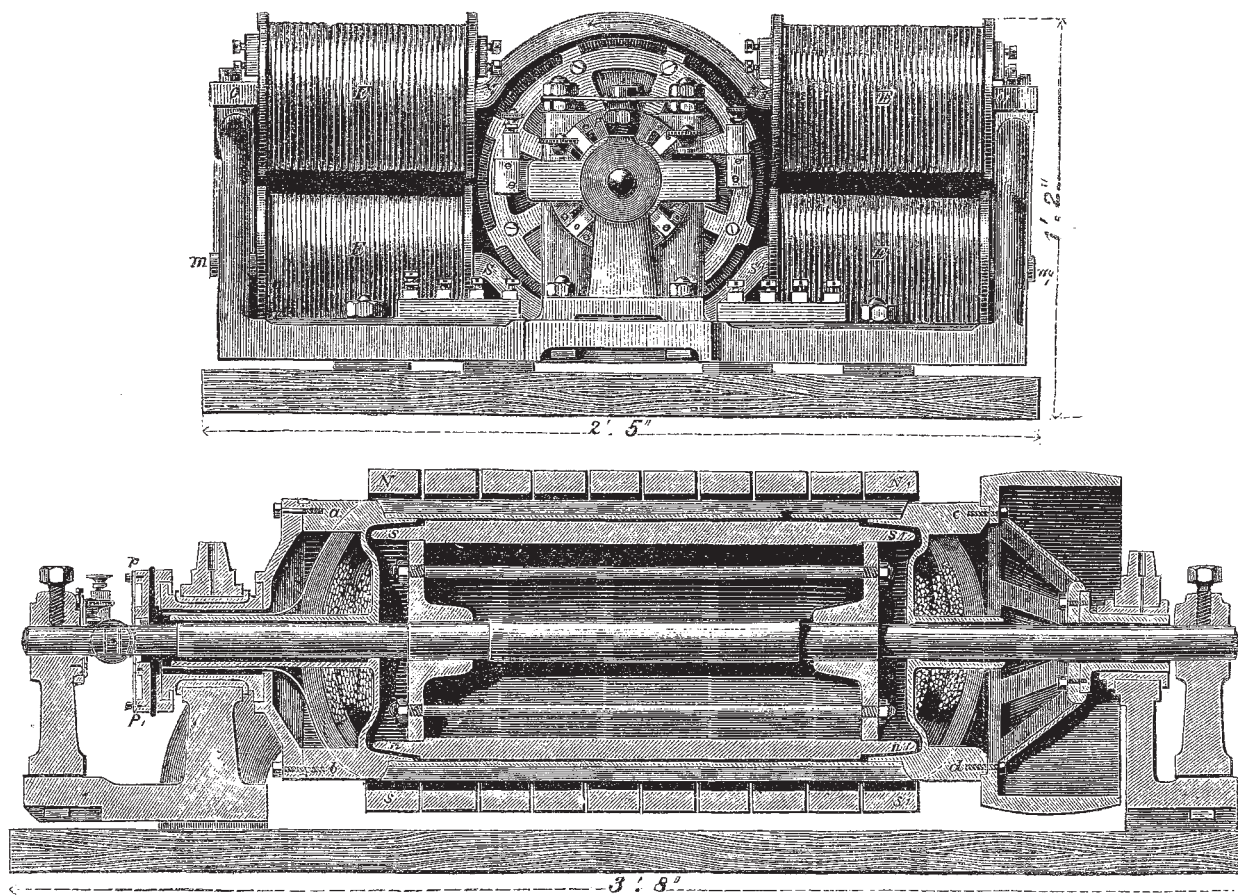


FIG. 2.—End Elevation and Longitudinal Section of Dynamo-electric Light Machine.

With about 380 revolutions of the wire-helix per minute, and nine to ten horse-power, a light equal to 14,000 candles is obtained.

The principle in this and all other magneto-electric machines is, that when part of a closed electrical circuit is passed between the poles of a stationary magnet, a current is generated in the circuit the direction of which depends upon the position of the magnetic poles and direction of motion of the conductor.

In this machine (shown in Figs. 1 and 2) the conductor, by the motion of which the electrical current is produced, is of insulated copper wire, coiled in several lengths, and with many convolutions on a cylinder of thin German silver, and in such a manner that each single convolution describes the longitudinal section of the cylinder. The whole surface of the metal cylinder is thus covered with

wire, forming a second cylinder closed on all sides (*a, b, c, d*, Fig. 2).

This hollow cylinder of wire incloses the stationary core of soft iron (*n s s' n'* Fig. 2) which is fixed by means of an iron bar in the direction of its axis, prolonged at both ends through the bearings of the wire cylinder to standards. Surrounding the wire cylinder for about two-thirds of its surface, are the curved iron bars (*NN' ss'* Fig. 2), separated from the stationary iron core by space only sufficient to permit the free rotation of the wire cylinders. The curved bars are themselves prolongations of the cores of the electro-magnets (*EE EE*) and the sides of the two horse-shoe magnets (*No—S, m* and *N'o'—s', m'*) are connected by the iron of the two standards (*om* and *o'm'*).

As the coils of the electro-magnets form a circuit with

the wires of the revolving cylinder, the revolution of the latter causes a powerful current to pass into the electro-magnetic coils, this again inducing a still more powerful current in the wires of the cylindrical armature. The iron core of the cylindrical armature being very close to the poles of the electro-magnets, becomes itself an intensely powerful transverse magnet of opposite polarity to the electro-magnet. The cylinder of wire thus revolves in a very intense magnetic field.

These electrical currents are collected on two metal rollers or brushes, so that at two points diametrically opposite the single sectors pass under the rollers or brushes with elastic pressure giving up to them their electrical charge.

A slight increase of speed in the rotation of the wire cylinder is followed by a considerable increase of current, but as the current increases, so does the resistance to rotation; and this very rapidly. In addition to this heat is developed to such an extent, that care must be taken not to exceed a certain limit, otherwise, the insulation of the coils would be destroyed. Were it not for this drawback almost any amount of current might be produced with suitable driving power.

As the external resistance affects the strength of the current the speed must be varied accordingly, being greater as the external resistance is greater and *vice versa*. With an electric lamp in a circuit of small resistance, if the machine is intended to work continuously, the revolutions of the wire cylinder per minute should not exceed 370 to 380. The temperature of the machine will then be at a maximum in about three hours; and during work will remain constant. At this speed the driving power is about eight indicated horse-power. While the intensity of the light, unaided by reflector or lens, has been shown by various photometers to be equal to 14,000 normal English candles. A more intense electric light cannot be obtained as any increase in the current splits up even the best carbon.

The conducting wires from the machine to the lamp should be of copper, offering very little resistance and at the same time possessing a high electrical conductivity. If the lengths of the two wires do not together exceed fifty-five yards, then a wire of 0.157 inches diameter, and of high conductivity will suffice. For longer distances it is advisable to use a strand of larger diameter.

Increased speed will of course compensate for decrease of current due to a too great external resistance, but this can be done only at the expense of increased motive power.

The lamp used with the machine is regulated without clockwork, as the employment of the latter has not only been a source of numerous failures and difficulties, but is liable to disarrangement upon the least rough usage. The lamp of itself regulates the carbon points, keeping them at a uniform distance, and thus a perfectly steady light is produced.

For concentration either a parabolic reflector or a Fresnel dioptric lens may be used.

For transportation the Dynamo-electric Light Apparatus is mounted on a wagon, with steam-engine, the whole weighing 4,960 lbs. The combination has proved very serviceable on account of its lightness and compactness.

THE ETHNOLOGY OF THE PAPUANS OF MACLAY COAST, NEW GUINEA¹

WITH regard to the villages and dwellings. So thickly is the coast of Astrolabe Gulf covered with vegetation that no houses are visible to anyone on shipboard, the only signs of habitation being perhaps columns of smoke. If, however, more careful observation be made with a telescope, separate groups of cocoa-nut palms will be noticed.

¹ Continued from p. 109.

If a landing be effected near one such group, a *piroque*, or canoe, will probably be seen drawn up on the shore, or else concealed in the jungle, and a path will be found leading through the wood to an open clearing, where stand huts overshadowed by bananas and cocoa-nut palms. Viewed from the side, one such hut seems almost wholly to consist of roof, as the side walls rise scarcely half a yard above the ground. A semi-circular eave-like projection frequently stands out over the doorway. Close in the neighbourhood of nearly every hut there stands upon four legs the *barla*, a kind of table or bench, which serves as the eating and resting-place of the men. Upon this, when the meal is ready, the host and his guests are seated, so that they can take their meal without fear of molestation from pigs or dogs. When the dishes are cleared away the Papuan takes his *siesta* upon the *barla*, which now serves as a kind of divan. The women on no account use the *barla*, but take their meals upon the ground. A village consists of several groups of huts (each group having a particular name) which stand around an open clearing, and communicate through narrow paths. The houses do not stand upon piles,¹ and are for the most part small and dark, though well and strongly built; the roofs in particular, which do not have a flatly-inclined surface, but bulge outside in order that the rain may be the easier carried off. The walls are made either of bamboo or of the stalks of sago-palm leaves. The door is raised generally about half a yard above the ground, to prevent the ingress of dogs and pigs.

There can generally be distinguished three kinds of huts—those of single people, those of families, and the *buambranra*, which is usually only used by men, being intended for the youths of the village, and any chance guest. Here will be remarked the *baroem*, a kind of gong, which plays so important a part in the life of the Papuans. It resembles a thick-sided boat resting upon two trestles, and on the middle of the outer side may be seen a smooth, much-worn patch, the place where it is hit with a very thick stick, by which is produced a dull but loud tone, which has been heard on the coast at as great a distance as five or six miles. All important events, *e.g.* the presence of an enemy, a death, or a feast, are by this instrument heralded to the neighbouring villages, the quality of the news being signified by the varying loudness of the tones produced, and the length of the pauses between each.²

It is a most extraordinary fact that all the people of the coast here have no means at all of making fire; wherefore they are obliged always and everywhere to carry a live coal with them, be it either to kindle a fire in a plantation, or, when on a long tour in the mountains, to relight their cigars, which, being wrapped in green leaves, are always going out. On their sea voyages they have generally a live coal at the bottom of the boat, in a broken pot partly filled with earth. Those who remain behind in the villages never forget to look after the fire, and even in the night a small fire is kindled under the sleeping-places, which partly makes up for scanty clothing. The warmth penetrates, together with smoke, through the interstices of the bamboo bedstead,³ so that one-half of the sleeper's body is warmed, in fact roasted, while the other half is frozen. They are often obliged to get up in the night to see after the fire. The mountain people are not obliged thus to tend, like the priestesses of Vesta, an eternal flame, but understand how to kindle fire anew, and by the following method. A piece of very dry wood, which they term *lol*, is split with a stone axe in such a manner that each half is not quite separated from the other. Into the fissure a strong cord, a split liana,

¹ The houses of all Malays, whether on the coast or in the mountains, always are built upon piles sometimes nine or ten feet long.—J. C. G.

² A similar instrument is figured in Schweinfurth's "Heart of Africa," as in use by the Niam-Niam tribe.—J. C. G.

³ This is probably the equivalent of the *bali-bali* of the Malays, a frame of split bamboo, raised slightly from the ground.—J. C. G.